# Keysight Technologies

# Using Source/Measure Unit as an Ammeter

## B2900A Precision Source/Measure Unit

Demo Guide


KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

# Introduction

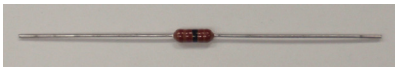
The Keysight B2900A Series Precision Source/Measure Unit (SMU) is a compact and cost-effective bench-top SMU with the capability to output and measure both voltage and current. The B2900A Series SMU enables you to make a wide range of current versus voltage (IV) measurements more accurately and quickly than ever before. In addition, the B2900A Series SMU comes with an intuitive graphical user interface (GUI) and free PC-based application software that make it easy for you to begin making productive measurements immediately.

This demonstration guide shows how easily you can use the Keysight B2900A Series SMU as an ammeter.

## Required Instrument and Accessories

All of the accessories required to perform the demos described in this demonstration guide are provided in a demo kit that is included with Keysight B2902A/12A demo units. The kit includes items such as a banana cable, a 1.1 kΩ resistor, etc.

Keysight B2902A/12A
Precision Source/Measure Unit



1.1 kΩ Resistor

11059A Kelvin Probe Set

U8201A Combo Test Lead Kit

# Concept

Figure 1 illustrates the connection diagram used in the demo to use the Keysight B2900A Series SMU as an ammeter. Since the current polarity of the SMU is opposite to an ammeter, the Low Force terminal of the channel has to be connected to the current output port of the device under test (DUT).

In this demo, a 1.1 kΩ resistor combined with a power supply is used as a DUT, a current source circuit. The channel 2 of the B2902A/12A is used as a power supply. However, you can also use your own power supply for it.

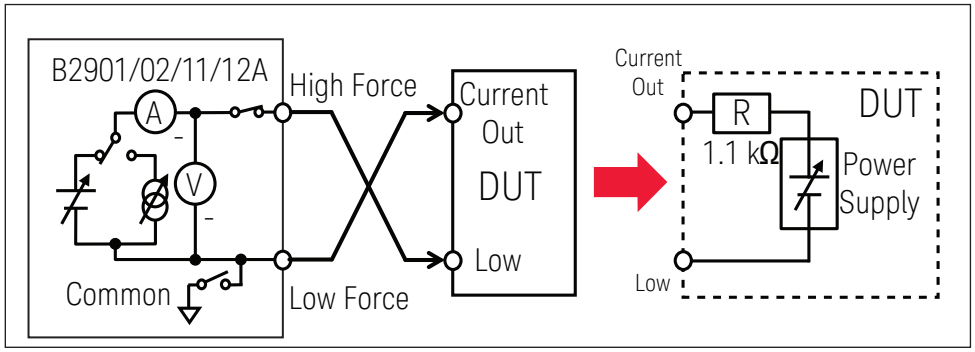
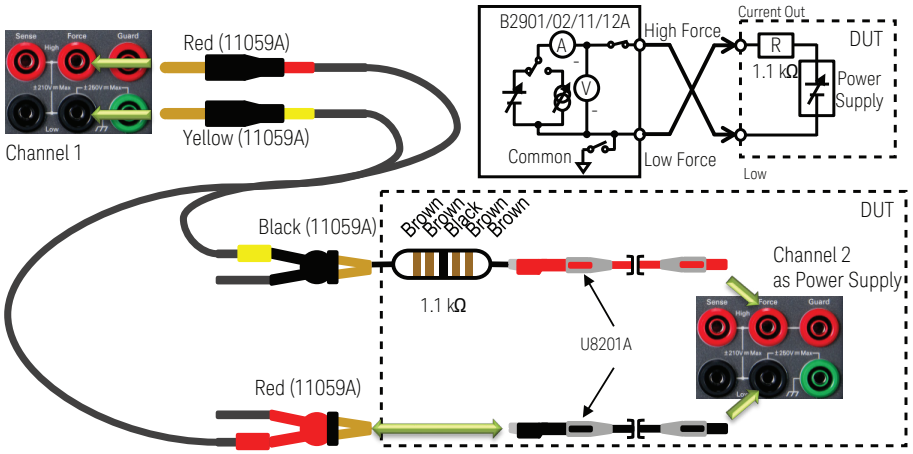



Figure 1. Connection diagram and basic condition

# Setup

1. Connect the **yellow banana plug** of the 11059A to the **Ch 1 Low Force** Terminal.
2. Connect the **red banana plug** of the 11059A to the **Ch1 High Force** Terminal.
3. Clip the **end of the 1.1 kΩ** resistor with the **black gold-plated tweezers** of the 11059A.
4. Connect the **black banana cable** of the U8201A to the **Ch2 Low Force** Terminal.
5. Connect the **red banana cable** of the U8201A to the **Ch2 High Force** Terminal.
6. Clip the other **end of the 1.1 kΩ** resistor with the **red alligator clip** of the U8201A
7. Connect the **red gold-plated tweezers** of the 11059A to the **black alligator clip** of the U8201A.



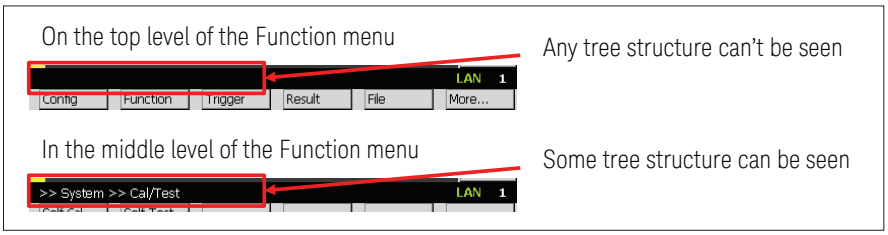
# LAB1: Use Source/Measure Unit as an Ammeter

## Demonstration

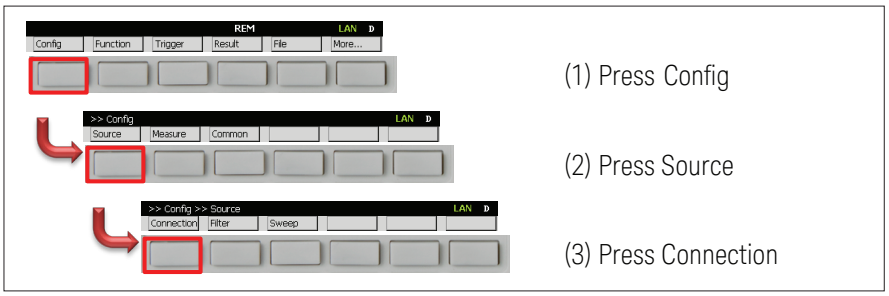
In the default setting, the low terminal of the channels in the Keysight B2900A Series SMU is grounded internally. However, the low terminal can be disconnected from the ground and kept floating. Configuring the low terminal state to FLOATING, which enables you to connect the low terminal to any potential up to ±250 V, and measuring current with sourcing 0 V from the channel, which makes it possible to use the channel as an ammeter.

## 1. Configure the low terminal state to FLOATING

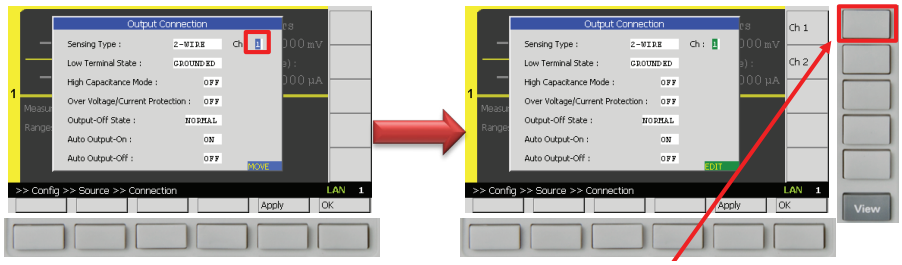
1) If you aren't on the top of the Function menu, press Cancel/Local repeatedly to return to the top level.




2) Press Config, Source, and then press Connection to open the **Output Connection dialogue.**




3) Press and select Ch 1 to specify the channel which the **Low terminal state** is configured for.



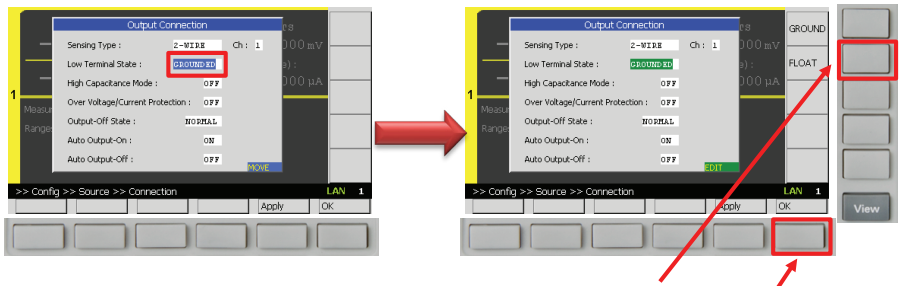

## Objective

This demo illustrates the current measurement function as an ammeter by sourcing 0 V voltage and measuring the current from the resistor biased by a power supply using a Source/Measure Unit.

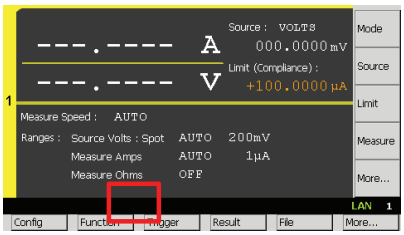
## Procedure

1. Configure the low terminal state to FLOATING
2. Measure current using the SMU (Channel 1) as an ammeter
3. Enable the DUT, the current soure circuit
4. Confirm measured current
5. (Optional) Configuring the measurement speed
6. (Optional) Configuring the measurement range operation

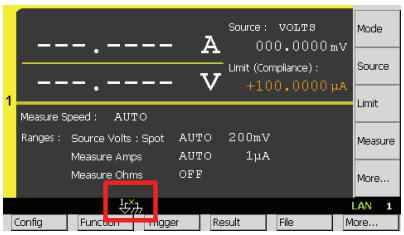
4) Press  and select FLOAT , and then press OK to configure the **Low terminal state** to **FLOATING**.




If the low terminal state of the channel is set to FLOATING, you can see the status indicator on the GUI as below, although no indicator can be seen on being set to GROUNDED.




GROUNDED




FLOATING

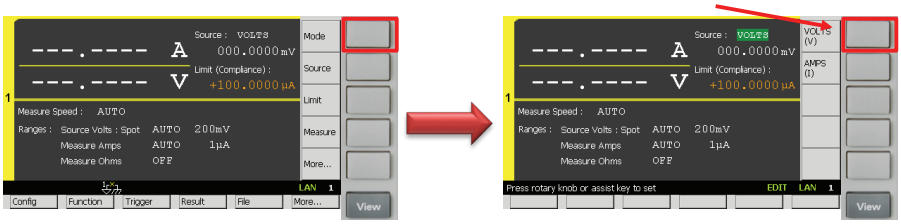
## 2. Measure current using the SMU (Channel 1) as a ammeter

### 2-1. Change View mode to Ch1 Single View

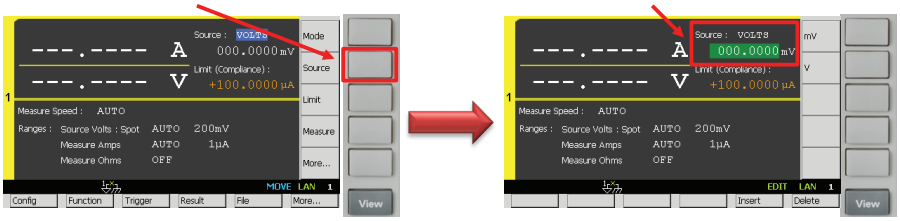
1) Press View repeatedly until the Channel 1 **Single View** is displayed


### 2-2. Configure the condition to source and measure

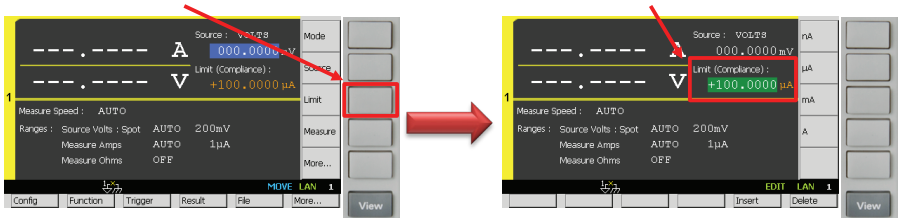
1) Press Mode to edit the **Source function**, and then select VOLTS (V) to set the **Source function** to **Voltage source**.



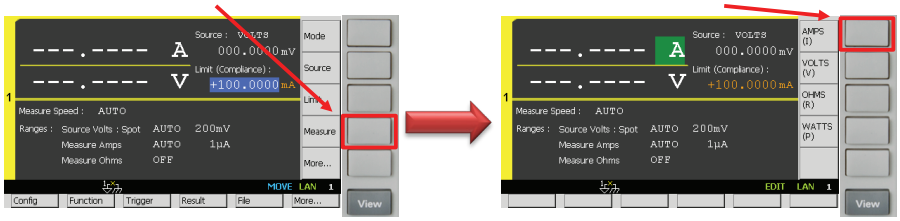
2) Press Source to edit the **Source value**, and then enter **0 V** to set the **Source value** to **0 V**.



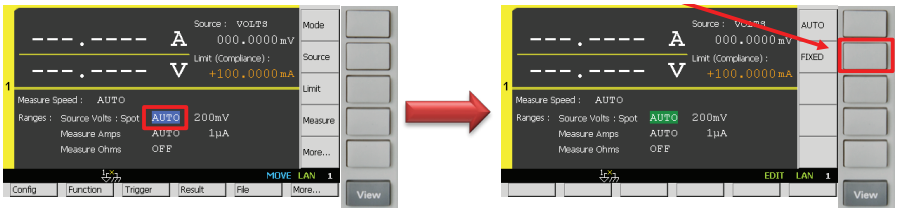
3) Press Limit to edit the **Limit value**, and then enter **100 mA** to set the **Limit value** to **100 mA** for example.



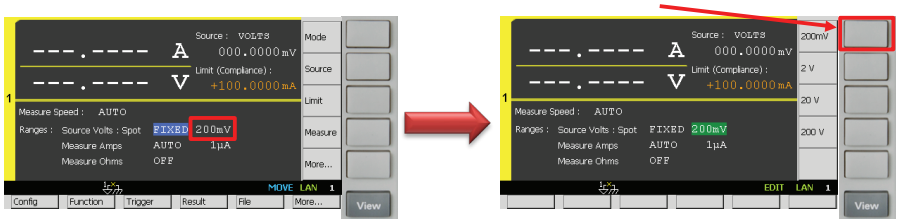
4) Press Measure to configure the **Measurement parameter**, and then select AMPS (I) to set the **Measurement parameter** to **Current**.



5) Rotate and press  to edit the **Voltage source range operation**. Then Select FIXED to set the **Voltage source range operation** to **FIXED**.



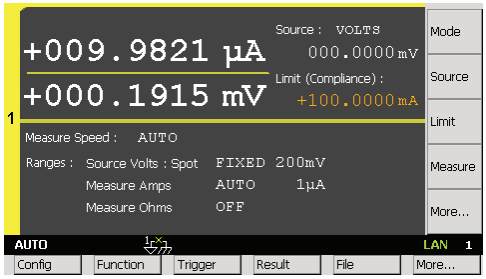
6) Rotate and press  to edit the **Voltage source range**, and then select 200mV to set it to **200 mV**.



## 2-3. Perform the measurement

1) Press On/Off for the channel 1 to switch on its output terminal.

2) Press Auto to perform a measurement repeatedly. Now you can see the measurement result on the GUI of the B2902/12A as below.




## 3. Enable the DUT, the current source circuit

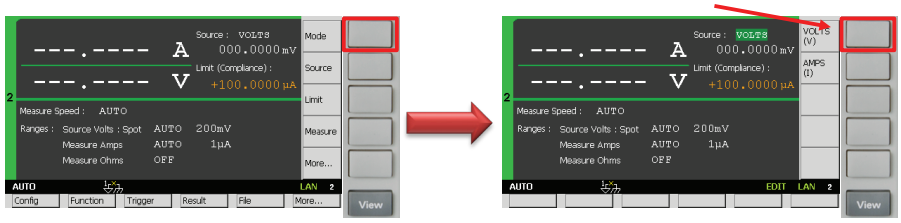
You can also use your own power supply instead of the channel 2 of the B2902A/12A

3-1. Change View mode to Ch2 Single View.

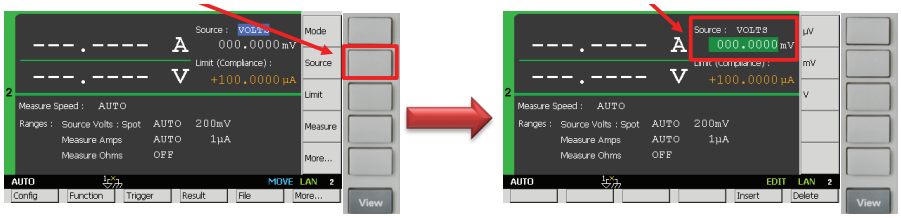
1) Press View repeatedly until the Channel 2 **Single View** is displayed.


3-2. Configure the condition of the power supply (Channel 2)

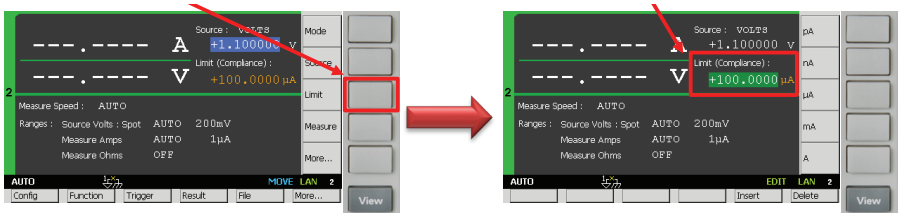
1) Press Mode to edit the **Source function**, and then select VOLTS (V) to set the **Source function** to **Voltage source.**



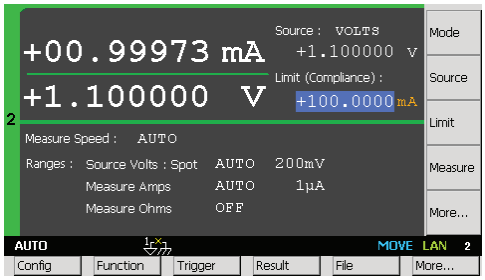
2) Press Source to edit the **Source value**, and then enter **1.1 V** to set the **Source value** to **1.1 V** for example.



3) Press Limit to edit the **Limit value**, and then enter **100 mA** to set the **Limit value** to **100 mA** for example.



4) Press On/Off for the channel 2 to switch on its output terminal and enable the DUT.

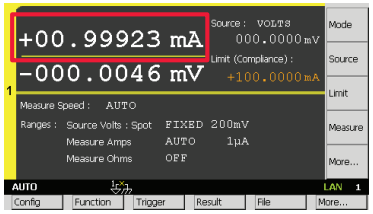



## 4. Confirm measured current

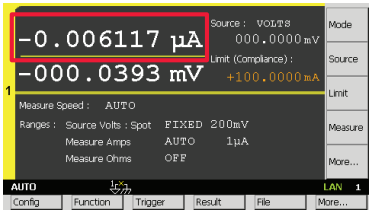
4-1. Change View mode to Ch1 Single View.

1) Press View repeatedly until Channel 1 **Single View** is displayed.


You can see about 1 mA as measured value, since 1 V is sourced to a 1.1 kΩ resistor. If you press On/Off for the channel 2 to switch it off, you can see only the offset current because the DUT, the current source circuit is disabled.




Power Supply enabled




Power Supply disabled

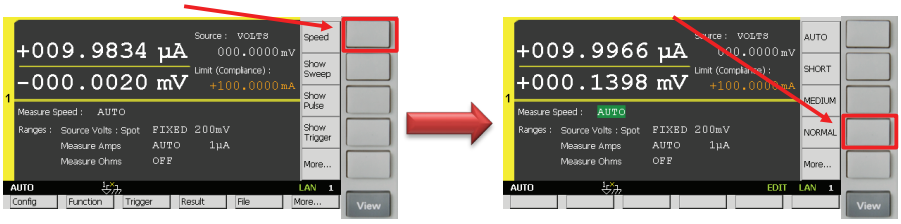
Theoretically speaking, the measured current should be 1 mA since 1.1 V is sourced to a 1.1 kΩ resistor. However, it may be varied because the resistor has some error on its value actually.

## 5. (Optional) Configuring the measurement speed

In the default setting, the instrument selects the appropriate measurement speed and range automatically to get the fine accuracy. However, you can also specify these parameters on the GUI of the B2900A Series SMU to meet a variety of the requirement to the measurement conditions.

For example, let's try to change the measurement speed to NORMAL to make a measurement more carefully. If you select NORMAL, the aperture time is set to 1 PLC. Here, PLC stands for power line cycle and the specified number of power line cycles is used per a measurement.

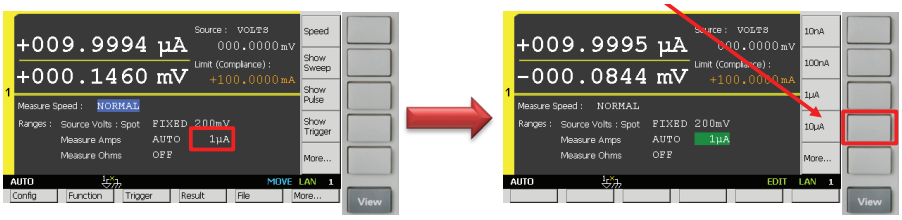
1) Press Speed to edit the **Measurement speed**, and then select NORMAL to set the **Measurement speed** to **NORMAL**. (If you can't see Speed in Assist keys, press More... to change the keys shown in Assist keys.)




## 6. (Optional) Configuring the measurement range operation

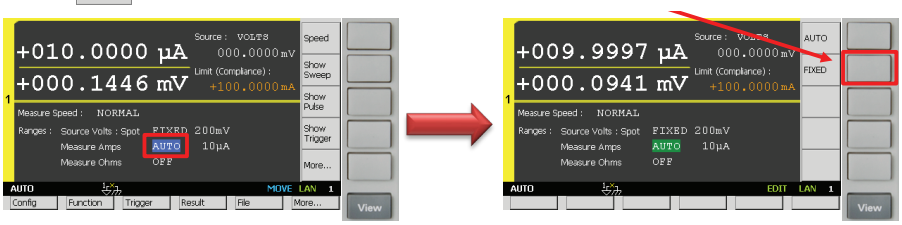
The parameters which configure the measurement range operation can be displayed in the Range Sub-panel in the Channel 1 Single View. In the default setting, the B2900A Series SMU performs the current measurement using a 1 µA current minimum measurement range with AUTO range operation. With AUTO range operation, the B2900A Series SMU selects the proper range for the measurement with the specified minimum measurement range so that you don't need to take care about it. To know how to change the measurement range setting, try to configure to use the 10 µA current minimum measurement range with AUTO range operation.

1) Rotate and press  to edit the **Current minimum measurement range** and then select 10µA to set it to **10 µA**.




If you'd like to fix the measurement range, you can select FIXED range operation as below.

2) Rotate and press  to edit the **Current measurement range operation**. Then Select FIXED to set the **Current measurement range operation** to **FIXED.**



# Conclusion

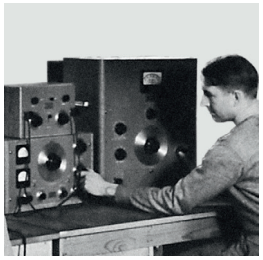
The Keysight B2900A Series Precision Source/Measure Unit (SMU) is a compact and cost-effective bench-top SMU with the capability to output and measure both voltage and current. Although it has the capability to make a wide range of current versus voltage (IV) measurements as its intrinsic function, the B2900A Series SMU can be used as an ammeter easily.

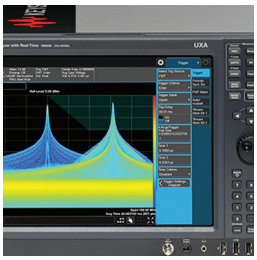
## B2900 Precision Instrument Family

The B2900 family contains products that perform both precision sourcing and precision measurement. **www.keysight.com/find/b2900a**

## Evolving

Our unique combination of hardware, software, support, and people can help you reach your next breakthrough. We are unlocking the future of technology.





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